Parademo: e-Democracy Based on a Delegated Expert Selection Process in a Small-World Network

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Abstract. Many countries have a representative democracy where their governments consist of a relatively small group of politicians that represent the values and beliefs of the majority of the voters. Unfortunately, many citizens are un- satisfied with their rather limited influence on politics especially regarding governments on national level or even higher like the EU or the UN. On the other side, referenda or direct democracies seem to be a too risky way of letting un- knowledgeable or uninterested individuals decide over complex issues. We mainly have these extreme opposites in our democracies due to the limitations of our manually maintained ballot system. Initiatives like Vivarto propose an alternative, called 'Delegated voting' where parts of a vote can be delegated to people with more knowledge on a certain topic. This leads to a convenient position in the middle between both mentioned extremes. We want to use the vast amount of expertise of many online citizens in our societies in selecting the right politicians and solutions. In this paper we propose the design of system called Parademo, that enables a fine-grained e-democracy. Next to this we briefly describe how we can achieve more transparency and third-party functionality by allowing listeners to subscribe to specific information-streams within communities that are formalized in a Semantic-Web language.

Keywords: E-democracy, Small-world expertise, Tokens, Fine-grained voting delegation, Semantic Web, Voting Cafés.

1 Introduction

Our democracies are mostly representative democracies, where in regular periods (often four years), people go to vote for their favorite party to represent their wishes and beliefs. The advantage of a representative democracy is that the average citizen often does not have the time or the right expertise to solve national problems. The problem remains however that the voter still has the burden to figure out which representative has the right knowledge and is trustworthy enough. This almost requires that the voter needs some expertise on the topic him/herself and should almost know the person to determine its trustworthiness.

The famous Milgram experiment [6] showed that the average 'acquaintance distance' between any two randomly selected persons is very small (around 6 hops). This means also that for any "Joe the plumber", the acquaintance distance to the president

of the United States is as small. Similarly, this holds between any voter and the best expert(s) for any topic. This means that everybody should have somebody in their acquaintance group who knows somebody closer to the best expert for a given problem. This leads to an important assumption in our paper:

We assume that most people are capable in identifying from their friends and colleagues the person(s) closer to the best experts and that during this selection process, members along the selection route have an increased expertise themselves to make valuable contributions in the decision making processes.

Analysis of massive online social networks show that also the graph of the relations between the members adhere the properties of a small-world network [7]. Therefore we make an even stronger assumption in this paper:

We assume that most members of an online social network are capable in identifying from their friends and colleagues (within the online network) those person(s) who are closer to the best online experts and that during this selection process, members along the selection route have an increased expertise themselves to make valuable contributions in the decision making processes.

The enormous amount of high-quality content on Wikipedia shows that there are many people who are 1) online, 2) are experts and 3) have an incentive of sharing it with the community for free.

Assuming that a large amount of these experts also participate in online social networks we perhaps can conclude that the time is ready to investigate if we can reform our representative democracy to an e-democracy.

The ballot systems in most mature representative democracies did not radically change in the last centuries. When we compare this with other important organizations in our societies, like the banking system, defense, the stock market, secret agencies, social security and health-care, it is surprising that computers play only a minor role in the way the core of our democracy is managed. The only digitalization that we currently see is that electronic alternatives are used for the paper ballots, but that the course-grained structure stays the same. A possible explanation for this slow pace is that most people do not trust the management of the democracy in hands of computers, especially when voting can be done at home behind a computer with an Internet connection.

In other words, ICT is often simplistically coupled to direct democracy, ignoring the need to be more specific on democracy [11]. Advances in computer science resulted in technology dealing with security and anonymity of online voting [3], although there are also serious concerns [8, 9].

There are already some promising examples of country-wide binding Internet Voting systems in Sweden [1], Estonia [5], Austria [4] and Brazil [8]. Although more fine- grained, these systems still are very similar to the 'classical' representative democracies with digital ways to vote.

In this paper we propose the design of a system, called Parademo[1] where the representative selection process is smoother by making the selecting process of the final representatives via the acquaintance chain within an online social network.

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[1] For latest information on Parademo, please visit http://www.parademo.org

Currently, there are already some approaches similar to the one we propose in this paper. For example, The World Parliament Experiment[2] is an Internet platform for political discussions. Besides elections, the forum allows people to debate in a structured way, discuss and share views. The focus of this system is more on the discussion process than selecting delegates for vote-distribution. This however gives us valuable lessons to create that part of the user interface taking for the "debate" phase (discussed later) of our Parademo system.

Vivarto[3] comes close to Parademo in the sense that they also focus on implementing a decision-making system based on delegating votes to more knowledgeable members in an organization. Unfortunately, the activity on development seems to be halted.

The MetaGovernment project[4] is most similar to the work presented in this paper. Like Parademo, the project is in a preliminary state and therefore there are still many things unknown, like the software design. Content-wise, there is at least one big difference: MetaGovernment is a direct democracy, where it (currently) is not possible to identify a group or person to delegate some of the voting decisions for specified topics. The core of Parademo is to allow members to delegate parts of the decision making process in order to relief most of the members of being 'mini-politicians' and to allow more knowledgeable members to get more influence.

Recently the European commission funded more than 21 projects by the "eParticipation" program[5]. The objectives of the program are to demonstrate how using modern ICT tools and applications can make it easier for people to participate in decision-making and can contribute to better legislation. Most of these projects focus on facilitating a platform to debate political issues or try to make the legislation more simple for the average citizen.

We hope by developing Parademo, we enable a fine grained delegation mechanism of expertise selection and hope to achieve that:

1. A reduction of the complexity may be expected in identifying the best candidates to govern an organization due to the delegated responsibility of the members who participate in an online social network.
2. An increase of usable expertise in the government may be expected due the increased number of available knowledge of the online community and allowing the most knowledgeable members to participate in the decision making process.
3. An increase of trust in the political system, resulting in an increased voting participation can be expected due to the smaller social distance between the voter and the delegates.

The remainder of this paper is ordered as follows: first we elaborate on the concept of e-voting and its relation to an e-democracy. After that we introduce the idea that votes are the currency of a democracy resulting in splitting votes into Tokens. After that we introduce Parademo, by defining the main concepts and member roles. Section 4 outlines the initial ideas behind the main algorithms to manage the Tokens and to calculate reputation of the members. In Section 5 we briefly describe an important implementation aspect of the Parademo software. We conclude with a summary and future work.

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[2] http://www.tgde.org/

[3] http://www.vivarto.com

[4] http://www.metagovernment.org

[5] http://www.eu-participation.eu/

2 Electronic Voting

Electronic voting (also known as e-voting) is a term encompassing several different types of voting, embracing both electronic means of casting a vote and electronic means of counting votes. Electronic voting technology can include punch cards, optical scan voting systems and specialized voting kiosks (including self-contained Direct-recording electronic (DRE) voting systems). It can also involve transmission of ballots and votes via telephones, private computer networks, or the Internet ... Internet voting can use remote locations (voting from any Internet capable computer) or can use traditional polling locations with voting booths consisting of Internet connected voting systems.

[Wikipedia]

In this paper we focus on the most advanced and controversial e-voting system, namely voting via the Internet. Voters have a 'budget' of Tokens that represent their 'voting power' in the communities where they are member of. Due to very limited possibilities for human control and guidance over the circumstances of the voter at home, we have to focus on technical and organizational solutions to guarantee the security, authentication of the voters, their privacy and the clarity and simplicity of the user- interface(s).

As we will discuss later, the members of the communities in Parademo can monitor and manage their Token placements from any computer with an Internet connection. The risks of this can be categorized in two parts:

1. Unauthorized observations and manipulations by unknown individuals. By this we mean somebody 'hacking' the computer. Payment systems of banks are currently considered a secure way to prevent this. We plan to use similar approaches for Parademo to prevent unauthorized tracking and manipulation of voting behavior. More on this in the section on the design of the Parademo system.
2. Unauthorized observations and manipulations of known individuals. In some families there might be a dominant individual that wants to control the voting behavior of the other family members. Due to the lack of control on privacy when voting at home, this is a serious problem. This problem holds for any decision- making process where there is no authority that controls the privacy of the decision makers. A solution for this problem has to be found in an organizational sense rather then technical. For example, a government could organize voting-cafés several locations in the country where citizens after identifying themselves can login on secure computers in a protected environment and spend time to participate in the e-democracy process. This also solves the previous problem where computers at home are more vulnerable to security problems.

The idea of Voting cafés is of course a rather costly solution, but probably the only possibility to make sure a voter can trust the computer (s)he is working on and participate in a private environment. Perhaps we have to accept that, next to roads and fire-brigades, Voting cafés should belong to the public infrastructure of future democracies and are paid by community funds (e.g. tax).

Next to security and privacy, we also have to deal with the different capabilities of the voters in working with computers. In other words, computer systems can be easy for the one, but intimidating for the other. Luckily we see that the improvement of the user-friendliness of interfaces, the increasing education on IT and increasing knowledge

of friends and family to help out. We assume that this leads to an increasing acceptance of doing things digitally. Splitting the ballots into Tokens, placing them, monitoring them etc. does not make life easier. Therefore, as a design requirement, Parademo will have different user-interfaces, where the simplest one is a one-to-one mapping to the traditional system: as a default an automatically subscribed member of a community can place once in four years a vote (the whole Token budget) on one of the parties within the subscribed community. Also all effort needs to be taken to keep the algorithms and monitoring system transparent and well documented. Next to this, when Voting cafés are organized, authorized instructors can help people in demonstrating the possibilities of the system (of course taking the privacy constraints in account).

3 Parademo as a Large-Scale Decision Making System for Communities

Any government is a kind of large dynamic decision making and execution system with a layered internal feedback loop. Similarly, also Parademo can be seen as such.

A decision making process involves participants, definitions, a mix of formal rules and protocols and conventions on behavior. The participants involved with the process can play several roles with different degrees of influence and responsibilities. Often, the larger the organizational complexity the more formal and explicit the protocols, audits and definitions are needed. We plan to use popular description logic language 'OWL'[2] to write down most stable parts of the model which has several advantages and also to use is as the language of the messages in the information-streams between the software components.

Given the ambitions of Parademo of facilitating also large governmental organizations, we focus on making most procedures and definitions as explicit as possible. Next to this, given the nature of the system, a computer system, it also needs to have a formal definition in order to translate parts to a programming language.

We first start with giving an overview of the basic concepts in Parademo. After that we list the different roles the participants can play. Finally, we describe the possibilities for members to form groups that can fulfill the role of the traditional notion of political parties.

3.1 Basic Concepts of Parademo

Communities. Our aspiration is that one Parademo 'system' can support many communities. For example, one community could be the national government 'community' of the Netherlands, and another community the 'Amsterdam' community. Every community has their own rules like the membership policies, token distribution policies etc. These are all written down in the community constitutions, partially in a formal language when automated support is desired.

Tokens. Every person allowed to vote within a community has a fixed budget of Tokens. These Tokens are the elements to express the agreement or disagreement with the different types of proposals, representatives, advisors or groups in Parademo. Later we describe what all these entail. The Tokens are uniquely bound to an owner, meaning that an owner normally never looses ownership. The owners always have the right to

see where their Tokens are placed at any moment. Based on the return policy described in the constitutions of the communities in Parademo, it can retract is immediately to its own account or has to wait for a determined period. Next to an owner, a Token has two date-pairs: the return-period and the place- period. The return-period indicates when the Token is to be returned to the local ac- count of the owner. The place-period indicates when the desired purpose of the placement should be executed. Both periods are based on the constitutions and the voter preferences in the respective communities.

Tokens also have a current-account, which is the account of a representative, a representative group, an advisor, an advisor group, who we generalize to delegates or a proposal account. The amount of Tokens in an account indicates the influence of the respective account in the system.

Tokens have a polarity indicating if it should have a positive or negative effect on the total influence of the current account. In this way, it counts as a vote in favor or against the 'owner' of the account. The owner and delegates can change the polarity of the Tokens that they have.

Categories can be seen as the different ministries that governments have. For example: Education, Immigration, Defense, Finance, Health-care. These categories are used to specify the topics of the proposals made in communities. Also they function to bind the Tokens. For example, you may trust your brother who is a medical doctor to delegate votes on the category 'health-care'.

Proposals are the initiators of any kind of change within the organization. This can be a proposition of a solution, a constitutional change or a management up- grade etc. Proposals have a proposal-type which is explained next. Proposals have a duration-request where members can place Tokens to lengthen or shorten the duration of the proposal-stage of the proposal. The constitution determines the maximum duration extension or reduction a proposal phase has.

Proposal types indicate the nature of the proposal. It can be the introduction or adaptation of a category, constitution change, proposing a member for a Role, an issue, a solution, a consensus-solution, a bid to plan, a plan, relevant external source, facts to live with and a critique. The constitution of each community determines for each proposal type the duration for the several stages and other procedures.

Hidden author option. Some proposals may be controversial. The member that makes such a proposal may think that revealing his/her identity can bias the decision making process, or even endanger his or her position. Therefore, it can be that a proposal has an anonymous author. The constitution determines the types of proposals that are allowed to be anonymous and also the changed statutorily value of it.

Proposal stages indicate the current stage of a proposal, which can be "candidate", "debate", "vote", "formal check", "formal check result", "accepted", "rejected", "retracted". Each phase has an agreed duration time, but as said can be subject to change within constitutionally determined margins.

Constitution. The constitution can be seen as the meta-rules of Parademo. Some examples are the rights and obligation of the member types, the distribution key of the different Tokens, the duration of phases etc. The members can submit proposals to make changes to the constitution.

Facts-to-live-with. Every government or other organization has to deal with some facts that constrain the possible decisions. For example, the national planning bureau can predict the available budget for the next year. In Parademo there is a list of these facts- to-live-with, public to its members and perhaps even to the visitors. These facts can then be used as formal material to legitimate proposals. Every 'fact-to-live-with' has a validity-period and references to 'proof' agreed as valid by a significant relevant part of the community.

3.2 Roles

The members of Parademo can have multiple roles. Each role comes with formally defined responsibilities, rights, behaviors and ethics. These are described in the constitution and therefore subject to change.

- **Members** are those who are being accepted as participant within one or more communities. They are at least allowed to vote within the subscribed communities. Membership can be achieved when the person successfully passes his or her membership-proposal.
- **Representatives** are members that agreed to make their voting behavior for some Categories public. By doing this, they gain the right to maintain a Token account for that topic, where other members can donate their Tokens. Representatives express their "categories constraints" in their public profile, in order not to receive any Tokens categories for which they don't want responsibility. Representatives can always decide to change these constraints with the result that Tokens which are not fulfilling the new constraints are returned to the previous placer, however with a built-in 'rethink' period (determined by the constitution).
- **Advisors** are representatives that also think to have expertise on the topics they are representatives about. Next to their obligation to make voting behavior on the categories public, also some of the types of the proposals falling under that category, will be enforced to be non-anonymous.
- **Planners** are voters that write concrete execution plans for accepted solutions. In Parademo this is considered to be a job, and planners can bid via an auction on Parademo to write executing plans. Planners cannot fulfill any other role than being a voter, this is to keep independence. Of course this is determined by the constitution and subject to change.
- **Ministers** are members who are responsible to execute accepted plans. To become a minister, the voter has to submit a proposal. This is also a 'rewarded job' where the minister, as part of the proposal, proposes the reward (s)he wants to have.
- **Administrators** are also rewarded members without the right to vote and are responsible for keeping the system running, blocking accounts (when allowed) etc. They have special privileges and obligations on observing behavioral patterns of the system and report to the community.
- **Developers** are members without the right to vote and are responsible for adapting features of the system according to agreed execution plans governed by ministers. Also this is considered a rewarded job.
- **Controllers** are members that have special rights to request for checking if things go well. It is a rewarded job. There are several types of controllers. For example those who can check the administration of ministers. Or controllers that audit the workings of the software. Controllers are obliged to report to the community in a periodical fashion.

3.3 Groups

Members can 1) create groups, 2) apply for membership and 3) place Tokens on groups.

The reason to have groups in Parademo is for convenience of the voters. Groups can function as conventional political parties, but also any other item relevant to Parademo, like a controllers group, administrators group etc. A group is treated by Parademo in the same way as a normal member however with some additional constraints, mainly on accountability. Parademo does not enforce any internal procedures, like the organizational structure and they creation of proposals etc. Membership can be private or public, ac- cording to the decision made by the group creator. Voters (not necessarily members of the group) may choose to place Tokens on the group for being advisor and/or representative. The group determines which group-members are allowed to place Tokens and make proposals via the collective group accounts. For convenience, we call the collection of representatives, representative groups, advisors and advisory groups: delegates. The placement behavior of these delegates are public. This allows other members to see if they are reliable and knowledgeable, and also automated reputation algorithms can analyze the behavior and summarize that for the members of the community. The proposals have the group name as the identifier of the author. The group announces in the group description the category constraints for which they accept Tokens.

4   Algorithms

4.1   Algorithm to Calculate the Weight of Proposals

As previously mentioned, all proposals in Parademo go through different stages. One of the stages is the "vote" stage. In that stage, voters, delegates, groups, and advisors can place their Tokens together with the polarities. Given our choice of Tokens as a currency instead of weight influence graph like Google's PageRank algorithm, the calculations can be fairly simple. Namely, the system counts the number of tokens in favor and against the proposals to detect if the proposal is controversial and compares it to the total number of Tokens in that Category to see if the proposal has a significant support within the effected community. If not, an extra round to request Consensus proposals. The ratios to determine if some proposal is controversial and has enough support is defined in the constitution.

4.2   Algorithm for Automated Reputation Feedback

As previously mentioned, a voter can anonymously place its Tokens on delegates. In contrast to this, the placements of delegates are public. This means that the placement routes in a community from delegate to delegate and from delegate to the advisor delegate that places the tokens can be monitored. When the owner of the Tokens checks the placements of the proposals that are in the "Vote" stage, (s)he can decide to retract it. When this happens, the whole route between delegates leading to the placement should be 'punished' because they are as a whole responsible for a placement on which the owner in the end did not agree with. How much 'punishment' each delegate in the route

should get is up to the designer of the algorithms and the parameters that are part of the constitutions. In the prototype we will have a simple counter for each hop. More advanced algorithms can be found in literature [10].

5   Listeners on Information Streams within Communities

A bit more technical is the concept of having listeners on information streams within communities. Listeners are software components that have authorized subscriptions on information-flows between the software components of Parademo that facilitate the particular communities. In this way these 'external components' can offer useful services for these communities. For example, every time a member-ship proposal is accepted, a Web-service can be informed about this in order to analyze trends. Listeners are only added after it passes a 'listener-proposal' for which community members have to vote.

These feeds also will be used by processes of the Parademo system itself, for example to monitor the behavior of critical components. Although we did not decide yet on the format of the information streams between the software components of Parademo, it is very likely that we will use RDF[6], because it is a very popular language to describe structured linked data and can be used by Semantic web reasoning tools and Semantic Web Mash-ups.

6   Summary and Future Work

In this paper we presented the design of a fine-grained electronic voting system to run a complex organization governed via a democratic process. The delegated democracy can be seen as a convenient position between a direct democracy and a representative democracy where the citizens can choose by themselves the amount of participation and accountability. Parademo tries to make use of the vast amount of available expertise currently unused in the official decision-making process of representative democracies. Next to this we try to increase the trust and participation of the citizens in their democracies, based on having a chain of delegates to smoothen and improve the decision making process. By using Semantic Web technology for standardizing and formalizing information-streams between the software components of Parademo, we hope to create a radical transparent system which can be monitored and extended by third parties. We plan to evaluate the algorithms and different settings of the initial constitution rule-set via large-scale simulations on the Distributed ASCI Supercomputer 3 (DAS-3), a five-cluster grid system in the Netherlands[7].

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[6] http://www.w3.org/RDF
[7] http://www.cs.vu.nl/das3/

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